



# State of Vermont

Department of Fish and Wildlife  
Department of Forests, Parks and Recreation  
Department of Environmental Conservation  
State Geologist  
Natural Resources Conservation Council

AGENCY OF NATURAL RESOURCES  
Department of Environmental Conservation  
**WATER SUPPLY DIVISION**

The Old Pantry  
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Waterbury, VT 05671-0403

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July 12, 1993

Mr. Mark Sceery  
EPA Water Supply Section  
JFK Federal Building  
Boston, MA 02203

Dear Mr. Sceery:

The Vermont DEC is submitting the attached waiver requests based on technical criteria for five synthetic organic compounds per the Phase II Rule. The Phase II Rule allows monitoring requirements to be waived if the compound can be shown not to be a threat. A waiver can be granted under technical criteria either through use or susceptibility. The following waiver requests are supported by lack of use of these compounds with the exception of glyphosate which is used in the State. A susceptibility waiver is requested for glyphosate.

The attached documentation provides a rationale of each particular compound and its use in Vermont. This information was supplied by the Vermont Department of Agriculture, Food, and Markets (VDAFM) which indicates that the compounds are non-threatening. The VDAFM supports the issuance of waivers for those compounds listed below.

The State of Vermont is requesting waivers for both surface water and groundwater sources for Diquat, Endothall, EDB, Glyphosate, and DBCP. Please review this request and respond indicating whether or not this request is granted.

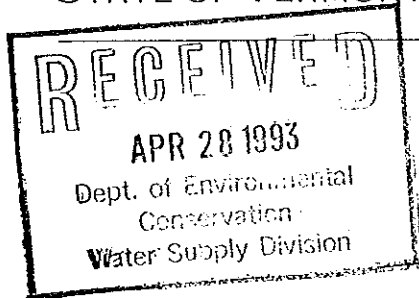
Sincerely,

Jay L. Rutherford, P.E.  
Director

cc: Phillip Benedict  
Canute Dalmasse



STATE OF VERMONT



DEPARTMENT OF AGRICULTURE, FOOD & MARKETS

OFFICE OF THE COMMISSIONER  
DIVISION OF AGRICULTURAL DEVELOPMENT  
DIVISION OF ANIMAL & DAIRY INDUSTRIES  
DIVISION OF PLANT INDUSTRY, LABORATORIES & CONSUMER ASSURANCE

MEMORANDUM

To: Jay Rutherford, Director  
Water Supply Division, D.E.C.

From: Philip Benedict, Director  
Plant Industry Division *Philip Benedict*

Date: April 27, 1993

Subject: Public Water Supply Phase II Waiver Recommendations

Thank you for your memoranda dated March 17, 1993 requesting the Departments recommendations on the issuance of public water supply monitoring requirements for the pesticide active ingredients DBCP (Dibromochloropropane), Diquat, EDB (Ethylene Dibromide), Endothall and Glyphosate.

To summarize your request, the questions answered in evaluating the Departments' position on waivers include:

- 1) Is the compound used in Vermont and if so, how much;
- 2) What are the use patterns for this compound and are applicators required to be certified;
- 3) Has the compound been detected in the environment; and
- 4) Does the Department of Agriculture, Food and Markets support the issue of a waiver for this compound.

An individual response for each of these compounds is attached. However, as I understand the requirements of the Safe Drinking Water Act (SDWA) Water Supply Rule, I have concluded that DBCP, Diquat, EDB and Endothall qualify for statewide use waivers. Glyphosate, on the other hand, is eligible for a statewide susceptibility waiver.

Once again, I wish to thank you and the Water Supply Division for the opportunity to participate in the waiver evaluation process. I look forward to the continued cooperation between our programs. If you wish to discuss the Departments' recommendations in further detail, please call me at 828-2431.



STATEWIDE WAIVER REQUEST FOR DIQUAT FROM PHASE II MONITORING  
REQUIREMENTS OF PUBLIC SUPPLY WELLS

Submitted to EPA Region I  
Groundwater and Water Supply Unit

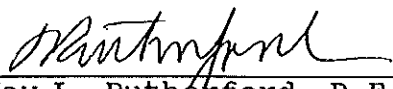
by

The Vermont Department of Environmental Conservation

The Phase II Rule is a federal regulation under the Safe Drinking Water Act which became effective January 1, 1993. The Rule established a waiver process based upon contaminant vulnerability. Vermont has reviewed the herbicide diquat to determine source vulnerability regarding this potential contaminant. This review concluded that minimal use of diquat in Vermont should provide the basis to waive statewide monitoring requirements. A statewide waiver means that no sampling need to occur. The resulting reduction in monitoring requirements will provide significant sampling cost savings.

Submission of this Vermont statewide use waiver for diquat per the Phase II Rule is accompanied by supporting documentation. The documentation includes a profile of the herbicide. This profile along use data regarding diquat as kept by the Vermont Department of Agriculture, Food, and Markets, (VDAFM) was evaluated. The attached evaluation was performed by the Plant Industry Division (PID) of VDAFM.

The Vermont Department of Environmental Conservation request a statewide waiver for diquat from EPA. That EPA respond within 30 days to this request because of Vermont's need to prepare public water systems in regard to the Phase II Rule.

  
Jay L. Rutherford, P.E. Director  
VT DEC Water Supply Division

## DIQUAT

### VERMONT USE

The herbicide diquat is legal for use in Vermont. Pesticide sales records dating back to 1988 indicate that use of diquat in Vermont is minimal. The following table lists the use of diquat since 1988.

	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
Pounds of Active Ingredient	98	50	117	86

### USE PATTERNS AND CERTIFICATION REQUIREMENTS

An examination of pesticide use and sales reporting data indicate that all use of diquat in Vermont is by private pesticide applicators. There have been no applications of diquat by commercial applicators for the years 1985 - 1991. The only existing use of diquat in Vermont is a vine desiccant for the harvesting of potatoes. The only counties with reported sales or use of diquat are Addison, Caledonia, Essex and Orange.

Diquat is a "Restricted Use" pesticide in Vermont. Therefore, diquat may only be sold by Class "A" pesticide dealers or purchased by certified applicators. Dealer licensing and applicator certification is an examination and training process regulated by the Vermont Department of Agriculture, Food and Markets. Diquat is also labeled as an aquatic herbicide. Aquatic applications of diquat require a permit from the Water Quality Division at D.E.C. The Water Quality Division reports that no permits for diquat use have been issued since 1968.

### ENVIRONMENTAL DETECTIONS

There have been no detections of diquat in Vermont groundwater or surface waters. A review of the Pesticides in Groundwater Data Base 1998 Interim Report published by EPA in December, 1988 list no detections of diquat in any of the 39 states with monitoring programs active at the time. Based on those preliminary monitoring results and the available environmental fate data, EPA did not consider it necessary to include diquat in the list of analytes for the National Pesticides in Groundwater Survey conducted in 1989 and 1990.

### RECOMMENDATION

The Vermont Department of Agriculture, Food and Markets supports the issuance of a statewide use waiver for the herbicide diquat. As discussed above, the minimal use of the compound in Vermont, the available data on environmental fate and the lack of detections in groundwater on a national scale support the conclusion that diquat does not present a risk to the groundwater resources of Vermont.

April, 1993

Agency of Natural Resources  
Department of Environmental Conservation

Water Supply Division  
The Old Pantry  
802-244-1562


MEMORANDUM

To: Philip Benedict, Director  
Plant and Industry Division

From: Jay L. Rutherford, P.E., Director

Date: March 17, 1993

Subject: Vulnerability of Water Systems to Diquat



The U.S. Environmental Protection Agency's National Primary Drinking Water Regulations are requiring water systems to monitor for additional chemicals. These chemicals include Diquat.

The cost of sampling is going to be a significant burden on Vermont's water systems, and especially on the small systems. Water systems can avoid sampling if it can be shown that their source is not vulnerable to contamination from potential contaminants. Systems that are not vulnerable to these chemicals may be issued a "use waiver" or a "susceptibility waiver."

A use waiver can be issued if a determination is made that either, a chemical was not used, or if it was used, manufactured, or stored in the area of review, is not likely to adversely impact a water system.

A susceptibility waiver is applicable if after a thorough review of the water system there is sufficient technical criteria (e.g., well depth, soil type, pesticide leachability, etc.) to determine that the water source is not susceptible to the contaminant. I have enclosed a brief summary of the above compound which endeavors to explain its environmental fate.

We support the issuance of waivers if appropriate. Waivers not only reduce the amount of bureaucratic paperwork but can also save water systems significant money. However, prior to issuing waivers we must be certain that a threat from a contaminant does not exist. To be certain, I request your

your input on the above compound.

We need to know whether or not the pesticide was used in Vermont and to what extent. The pesticide sales summary for 1989 from your office indicates that 50 pounds of diquat were sold in the state. I'd appreciate information on the total amount of chemical used in the State and when it was used. If used, on what, how is it applied, and does the application require some one who is certified or licensed. Also, are these pesticides found in environment, particularly in water, and finally, does the Department of Agriculture, Food and Markets support the issuance of a statewide waiver for diquat for public community water supply systems.

If you need additional information from me in order to make the requested determinations, I'd be pleased to provide it for you.

Thanks

cc

Jeff Comstock

John Berino

David Butterfield

## DIQUAT

### SYNONYMS

Aquacide, Dextrone, Weedtrine-D, Reglone, Reglox, Aquakill, and Vegetrole.

### PHYSICAL PROPERTIES

Dark reddish brown in aqueous solution and is a yellow solid. Diquat is soluble in water but insoluble in organic solvents, it is slightly soluble in alcohol. Vapor pressure is very low and will not appreciably volatilize from soil or water. It has a melting point of 335-340C and a specific gravity of 1.22-1.27.

### USE

Diquat is used as a desiccant on potatoes and as a herbicide on such seed crops as alfalfa, clover, sorghum, soybeans, and vetch. It is considered a contact herbicide because it causes injury only to the parts to which it was applied (Extoxnet). It is nonselective and can destroy nontarget plants. On seed crops diquat is applied 2 weeks to 3 days preharvest, depending on the crop, and the seed is not to be used for food, feed, or oil. It has also been used on canals, lakes, and ponds. Treated water from canals, lakes, and ponds is not to be used for human or animal consumption, spraying, or overhead irrigation within 10 days of treatment. The Environmental Protection Agency estimates that about 50% of the available diquat or about 100,000 lbs., was used in agricultural aquatic areas and the remaining diquat was used for industrial sites (Division of Federal State Relations, Food and Drug Administration, 1983). The pesticide sales summary for 1989 reports that 50 lbs., of diquat were used in the state (VT Department of Agriculture, 1992).

### ENVIRONMENTAL FATE

Diquat is released to the environment as a herbicide, seed desiccant, and aquatic weed control agent. It is subject to photolysis (half life approximately 2 days) and atmospheric deposition. It binds tightly to the soil and remains there for long periods of time. Once bound to the soil it is considered irreversible and is unavailable for biodegradation and photodegradation. Diquat is removed rapidly from aquatic systems, principally by adsorption. If adsorption is initially to weeds, biodegradation to soluble or volatile product occurs in several weeks. When absorbed to sediments, little or no degradation probably occurs, although it will disappear from water in 2-4 weeks. Human exposure is principally to agricultural workers (Howard, Phillip, 1991).

### Biological Fate

Diquat is rapidly absorbed by the leaves of plants. This occurs so quickly that it is not translocated or moved to other parts of the plant, it damages the plant on contact. The herbicide

interferes with cell respiration and desiccates the plant.

Diquat fed to dogs and rats resulted in the formation of cataracts. Moderate to severe membrane irritation took place when diquat was put on the eyes of rabbits. Based on acute and subchronic animal studies, diquat was found to cause serious toxic effects and mortality at very low doses. Studies show that 200 to 400 mg/kg of diquat are deadly, death occurred in one half (50%) of the animals which were experimentally fed the herbicide (Eatonet). Cattle were also found to be sensitive to diquat. Inhalation of diquat may cause oral or nasal irritation.

Diquat is toxic to both birds and fish. However, there is no accumulation of the compound in fish. One investigation of fish showed that one half of the herbicide was lost in less than three weeks (Extonet).

#### Soil Fate

Diquat is strongly adsorbed to clay and organic matter in the soil (MA Dept. of Food and Agriculture, 1985, and Howard, Phillip, 1991). Once absorbed it is resistant to biodegradation and photodegradation. This strong bond makes the chemical inactive, that is, it is not likely to 1) be leached away, 2) taken up by plants, 3) broken down by microbial degradation, 4) broken down through photodegradation. Residues of diquat in soil have been found to persist for years with little to no degradation (Extonet). However, it should be noted that any residual activity of diquat is only a few days after being bound to soil. In some cases, such as montmorillonite clay, absorption is considered irreversible (Howard, Phillip, 1991). Diquat is found in the upper few inches of soil. Soil capacity for adsorption of diquat is so high in comparison to the rate at which it is applied that there is little possibility that leaching could take place. However, there is also evidence that diquat has the ability to saturate the soil (Extonet).

#### Water Fate

Diquat is applied to water as a weed control agent, studies indicate that it is not persistent. When applied to open water, it disappears quickly since it binds to suspended particles. It has a half life of 48 hours (Extonet). Diquat disappeared entirely from two experimental pond studies in 14 and 30 days, it was more persistent in the pond with the lower average temperature. Although, it was noted that the colder pond was also less turbid. In other studies, diquat concentrations in a reservoir declined from 1000 to 9ppb in 12 days and levels in New York lakes declined to <.005 ppm 8 days after 4.8 kg/ha was applied. It was contended that diquat was adsorbed to hydrosol (Howard, Phillip, 1991).

Groundwater quality can be affected if the soil is totally saturated with diquat. This condition would allow the nonabsorbed herbicide to leach into the groundwater (Howard, Phillip, 1991). However, available information indicates that diquat has not been sampled for in groundwater due to its low potential for groundwater contamination (MA Dept. of Food and Agriculture, 1992).



The EPA requires a 14 day interval between treatment of water with diquat and use of treated waters for domestic, livestock, or irrigation purposes, including swimming and fishing. The herbicide cannot be used for any purpose in commercial fish processing areas (Extonet).

#### Air Fate

Diquat, when sprayed into the atmosphere should be considered an aerosol. It will be subject to photolysis (half life approximately 48 hours) and gravitational settling (Howard, Phillip, 1991).

#### TOXICITY

Diquat may be fatal to humans if swallowed, inhaled, or absorbed through the skin. The probable oral lethal dose of diquat is between 50 and 500 mg/kg, or between a teaspoon and an ounce for a 154 pound person. Diquat is acutely toxic upon dermal exposure and its toxicity increases as exposure is repeated. Human eye damage has occurred resulting in scarring of the cornea, cataract formation taken place in dogs and rats fed diquat. Studies indicate diquat has an LD50 of 200 to 400 mg/kg. Cows appear to be very sensitive to diquat, with an oral LD50 of 30 mg/kg (Extonet).

Extension Toxicology Network, Cooperative Extension Offices of Cornell University, The University of California, Michigan State University, and Oregon State University.

Farm Chemicals Handbook, 1989

Harrison Biotech 1985, A generic Environmental Impact Report on the Control of Vegetation on Utility and Railroad Rights of Way in the Commonwealth of Massachusetts. prepared for the Department of Food and Agriculture.

Howard, Phillip, 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Lewis Publishers.

Kaprielian, Gail, 1992. The Commonwealth of Massachusetts, Department of Food and Agriculture, personal communication with Tara Gallagher, Massachusetts Department of Environmental Protection.

State Services Branch, Division of Federal State Relations Food and Drug Administration, 1983. Use of the FDA Surveillance Index in Planning Pesticide Residue Monitoring Programs, Rockville, Maryland.

USEPA 1986, Guidance for the re-registration of Pesticide Products Containing Diquat Dibromide as the Active Ingredient, Office of Pesticides and Toxic Substances, Washington DC

Vermont Pesticide Summary for 1989, personal communication with the Vermont Department of Agriculture, 1992.

STATEWIDE WAIVER REQUEST FOR DBCP FROM PHASE II MONITORING  
REQUIREMENTS OF PUBLIC SUPPLY WELLS

Submitted to EPA Region I  
Groundwater and Water Supply Unit

by

The Vermont Department of Environmental Conservation

The Phase II Rule is a federal regulation under the Safe Drinking Water Act which became effective January 1, 1993. The Rule established a waiver process based upon contaminant vulnerability. Vermont has reviewed the fumigant dibromochloropropane (DBCP) to determine source vulnerability regarding this potential contaminant. This review concluded that the absence of DBCP use in Vermont provides the basis to waive statewide monitoring requirements. A statewide waiver means that no sampling need to occur. The resulting reduction in monitoring requirements will provide significant sampling cost savings.

Submission of this Vermont statewide use waiver for DBCP per the Phase II Rule is accompanied by supporting documentation. The documentation includes a profile of the fumigant. This profile along use data regarding DBCP as kept by the Vermont Department of Agriculture, Food, and Markets, (VDAFM) was evaluated. The attached evaluation was performed by the Plant Industry Division (PID) of VDAFM.

The Vermont Department of Environmental Conservation request a statewide waiver for DBCP from EPA. That EPA respond within 30 days to this request because of Vermont's need to prepare public water systems in regard to the Phase II Rule.



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Jay L. Rutherford, P.E. Director  
VT DEC Water Supply Division

DIBROMOCHLOROPROPANE  
(DBCP)

VERMONT USE

The fumigant DBCP is not legal for use in Vermont. The final use of DBCP (pineapples) was cancelled by EPA in 1985. Pesticide use records dating back to 1985 indicate that DBCP was not being use in Vermont when the cancellation was enacted. All other uses except pineapples, had been cancelled by EPA in 1977.

USE PATTERNS AND CERTIFICATION REQUIREMENTS

DBCP has no history of use in Vermont. The crops for which DBCP was applied as a soil fumigant were not grown in Vermont. These crop types include citrus, cotton, grapes, peaches, peanuts, melons, various vegetables and stone fruit and nut trees.

ENVIRONMENTAL DETECTIONS

There have been no detections of DBCP contaminated soil or groundwater in Vermont.

RECOMMENDATION

The Vermont Department of Agriculture, Food and Markets supports the issuance of a statewide use waiver for the fumigant DBCP. The history of non-use in Vermont supports the conclusion that DBCP does not present a risk to the groundwater resources of Vermont.

April, 1993

Agency of Natural Resources  
Department of Environmental Conservation

Water Supply Division  
The Old Pantry  
802-244-1562

MEMORANDUM

To: Philip Benedict, Director  
Plant and Industry Division

From: Jay L. Rutherford, P.E., Director *J. L. Rutherford*

Date: March 17, 1993

Subject: Vulnerability of Water Systems to DBCP

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The U.S. Environmental Protection Agency's National Primary Drinking Water Regulations are requiring water systems to monitor for additional chemicals. These chemicals include DBCP.

The cost of sampling is going to be a significant burden on Vermont's water systems, and especially on the small systems. Water systems can avoid sampling if it can be shown that their source is not vulnerable to contamination from potential contaminants. Systems that are not vulnerable to these chemicals may be issued a "use waiver" or a "susceptibility waiver."

A use waiver can be issued if a determination is made that either, a chemical was not used, or if it was used, manufactured, or stored in the area of review, is not likely to adversely impact a water system.

A susceptibility waiver is applicable if after a thorough review of the water system there is sufficient technical criteria (e.g., well depth, soil type, pesticide leachability, etc.) to determine that the water source is not susceptible to the contaminant. I have enclosed a brief summary of the above compound which endeavors to explain its environmental fate.

We support the issuance of waivers if appropriate. Waivers not only reduce the amount of bureaucratic paperwork but can

to issuing waivers we must be certain that a threat from a contaminant does not exist. To be certain, I request your input on the above compound.

We need to know whether or not the pesticide was used in Vermont and to what extent. I'd appreciate information on the total amount of chemical used in the State and when it was used. If used, on what, how is it applied, and does the application require some one who is certified or licensed. Also, is this pesticides found in environment, particularly in water, and finally, does the Department of Agriculture, Food and Markets support the issuance of a statewide waiver for diquat for public community water supply systems.

If you need additional information from me in order to make the requested determinations, I'd be pleased to provide it for you.

Thanks

cc: Jeff Comstock  
John Berino  
David Butterfield

## DBCP

### SYNONYMS

Nemafume, Nemagon, Fumazone, and 1,2-Dibromo-3-Chloropropane

### PHYSICAL PROPERTIES

DBCP is a light yellow to brown solid, and a clear liquid. It has a boiling point of 196C, a specific gravity of 2.08 at 20C, and a pungent odor. DBCP is volatile and has a vapor pressure of 0.58 mm Hg at 20C it is also soluble in water with a water solubility of 1,230 mg/L at 20C. It is not known to occur as a natural product.

### USE

DBCP was used as a fumigant and nematocide. As a nematocide it was widely used on more than 40 crops up until 1977. However, in 1979 EPA restricted its use to Hawaiian pineapples. In 1984, the EPA then moved to ban this remaining use of DBCP in the Hawaiian Islands after obtaining significant information showing groundwater contamination. Approximately 130,000 pounds of the substance were used annually on the island of Maui at two pineapple plantations consisting of 8,000 acres. DBCP was also used in other states and has been found in groundwater in AZ, CA, HI, MD and SC.

Its use is thought to have caused the most widespread groundwater contamination in California (CA). In 1979, the Central Valley Regional Board of Ca discovered DBCP in groundwater. Eight years after the ban of DBCP, it is still being found in the groundwater of CA (D. Cohen, 1986)

### ENVIRONMENTAL FATE

The use of DBCP was banned in 1985 by the EPA. With this in mind further release of DBCP into the environment is not expected. If released to the soil, it will be subject to volatilization and leaching, any remaining residues are very persistent. For instance, DBCP residues have been found in soil six or seven years after application. Volatilization of DBCP is its prime fate, volatilization half life of DBCP are estimated between 0.6 and 26.2 days. Leaching to groundwater is anticipated since DBCP does not strongly absorb to all soils. Data from groundwater studies also confirm this. Biodegradation is not thought to be significant since residues have been found so long after application (Phillip Howard, 1991).

#### Biological Fate

DBCP is not expected to be found in fish or other aquatic organism as it has a low affinity for organic matter. It has been found in roots and can be trans-located in plants. In foods, it has been found in peaches, radishes and carrots (Howard, Phillip, 1991). Biodegradation may be significant, for example significant residues of DBCP were found at sites six to seven years after known application, however, relative to leaching and volatilization it is considered a slow process.

## Soil Fate

DBCP has a low affinity for soils and therefore, readily leaches to the groundwater. Studies were performed to determine the migration of DBCP using fine grain sand as a soil. DBCP exhibited high to very high mobility rates as predicted. Additional studies showed that clay and silt had lower mobility rates than the sand (Phillip, Howard, 1991). These results are confirmed by field studies of DBCP contaminated groundwater. In California, the use of DBCP has resulted in the most widespread pesticide contamination known. Of 8,190 wells monitored in 1984, 30.8% (2457) were found to contain DBCP. In areas of Fresno County over half the wells sampled were identified with the pesticide. A replacement well was drilled in an effort to obtain DBCP free water. However, the chemical was detected at a depth of 420 ft. even though care was taken to prevent the transfer of contaminated surface soil. An additional study showed that DBCP occurred throughout 30 feet of soil profile (Cohen, D. 1986). Once released to the soil DBCP is subject to volatilization and leaching, however, residues have been found to persist years after application.

## Water Fate

DBCP was banned in 1979 because the Environmental Protection Agency found that the pesticide could runoff farmland and migrate to drinking water supplies (Environment Report, 1992). In surface waters, a study showed that water sampled between 1979 and 1980 had concentrations below detection (0.008ug/L) to 0.05ug/L in areas of little to no DBCP use. In this same study, DBCP was found in 18 of 48 surface water samples with concentrations up to 0.35ug/L in areas of high use (Howard, Phillip, 1991). In Massachusetts, DBCP is absent from surface water supplies (Corte-Real Lee, 1992).

As mentioned, many water wells were found to be contaminated with DBCP in California. Municipal wells in Hawaii and Arizona were also found to be contaminated. Finished municipal water taken between 1981 and 1982 at 280 random sites in the U.S. serving less than 10,000 person were 0.4% positive with DBCP. In South Carolina, ground water was sampled from wells in areas of high DBCP use and 29 of 49 wells tested positive Howard, Phillip, 1991). In Massachusetts, DBCP has not been confirmed in the state's monitoring program (Corte-Lee, 1992). However, human exposure to this pesticide is expected to result primarily from ingestion of drinking water (Howard, Phillip, 1991).

## Air Fate

DBCP has been reported as a low level contaminant in the air (U.S. Environmental Protection Agency, 1987). In two cases, significant amounts of DBCP were found in air surrounding bromine industry chemical plants. In Magnolia, Arkansas, the range of DBCP

concentration near the Dow Chemical Company was 1,688 to 6,653 ng/m<sup>3</sup>. At a El Dorado cite in the same state, concentrations were only as high as 187 ng/m<sup>3</sup>. Inhalation of the compound is remote since DBCP is no longer used as a soil fumigant in the U.S. (Howard, Phillip, 1991).

#### TOXICITY

DBCP has been studied for its carcinogenic affects and it has been found to have a significant dose related occurrence of cancer in mice and rats. It was also shown that DBCP is a tumor initiator in the skin, a mutagenic, and fatal to embryos in rats. Exposure of pregnant woman to drinking water containing 3ppb of DBCP or less in California were investigated though negative results were concluded. These mothers and their offspring were not affected in terms of birth weight, birth injury, or birth defects. Exposure to DBCP did result in reduced sperm counts in men (U.S. Environmental Protection Agency, 1987).

Cohen, D. 1986. Ground Water Contamination by Toxic Substances, State Water Resource Control Board, Sacramento, Ca.

Corte-Real, Lee, 1992. personal communication, The Commonwealth of Massachusetts, Department of Food and Agriculture  
DBCP Health Advisory, 1987. U.S. Environmental Protection Agency.

Environment Reporter, 1992. Drinking Water, The Bureau of National Affairs, Washington D.C.

Howard, Phillip, 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Lewis Publishers.



STATEWIDE WAIVER REQUEST FOR EDB FROM PHASE II MONITORING  
REQUIREMENTS OF PUBLIC SUPPLY WELLS

Submitted to EPA Region I  
Groundwater and Water Supply Unit

by

The Vermont Department of Environmental Conservation

The Phase II Rule is a federal regulation under the Safe Drinking Water Act which became effective January 1, 1993. The Rule established a waiver process based upon contaminant vulnerability. Vermont has reviewed the fumigant ethylene dibromide (EDB) to determine source vulnerability regarding this potential contaminant. This review concluded that the absence of EDB use in Vermont provides the basis to waive statewide monitoring requirements. A statewide waiver means that no sampling need to occur. The resulting reduction in monitoring requirements will provide significant sampling cost savings.

Submission of this Vermont statewide use waiver for EDB per the Phase II Rule is accompanied by supporting documentation. The documentation includes a profile of the fumigant. This profile along use data regarding EDB as kept by the Vermont Department of Agriculture, Food, and Markets, (VDAFM) was evaluated. The attached evaluation was performed by the Plant Industry Division (PID) of VDAFM.

The Vermont Department of Environmental Conservation request a statewide waiver for EDB from EPA. That EPA respond within 30 days to this request because of Vermont's need to prepare public water systems in regard to the Phase II Rule.



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Jay L. Rutherford, P.E. Director  
VT DEC Water Supply Division

## ETHYLENE DIBROMIDE (EDB)

### VERMONT USE

The fumigant EDB is not legal for use in Vermont. The use of EDB was cancelled by the EPA in 1983. Pesticide use records dating back to 1985 confirm the halt in use after that time.

### USE PATTERNS AND CERTIFICATION REQUIREMENTS

Prior to 1983, The use of EDB in Vermont was not extensive. In Vermont, EDB was used primarily to treat grain in railroad cars and to sterilize potting soil for nurseries and greenhouses. The crops for which EDB was applied as a soil fumigant in the field were not grown in Vermont. These crop types include citrus, pineapples, soybeans, cotton, tobacco and various fruits, vegetables or nut trees. EDB was also labeled for use on strawberries but was not the soil fumigant of choice in Vermont.

For the purpose of evaluating drinking water monitoring requirements for EDB, it is important to consider that EDB was also used as an anti-knock compound in gasoline. At the time of cancellation in 1983, EPA estimated that only 10% of annual production was used by agriculture. The remaining 90% was used for other industrial purposes.

### ENVIRONMENTAL DETECTIONS

There have been no detections of EDB contamination of soil or groundwater from the agricultural use of EDB in Vermont. Following the cancellation of EDB in 1983, all product in Vermont was returned to distributors through an EPA sponsored recall program. Any material collected by dealers was eligible for collection and disposal. In 1984, the Department conducted an EDB storage investigation at all dealerships. EDB stocks were found at just one location. This remaining material was shipped out of state for collection by the parent company.

### RECOMMENDATION

The Vermont Department of Agriculture, Food and Markets supports the issuance of a statewide use waiver for the fumigant EDB. The history of limited use in Vermont and confirmation of the effective collection and disposal of cancelled product stocks support the conclusion that EDB does not present a risk to the groundwater resources of Vermont.

April, 1993

Agency of Natural Resources  
Department of Environmental Conservation

Water Supply Division  
The Old Pantry  
802-244-1562

MEMORANDUM

To: Philip Benedict, Director  
Plant and Industry Division

From: Jay L. Rutherford, P.E., Director *J. L. Rutherford*

Date: March 17, 1993

Subject: Vulnerability of Water Systems to EDB

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The U.S. Environmental Protection Agency's National Primary Drinking Water Regulations are requiring water systems to monitor for additional chemicals. These chemicals include EDB.

The cost of sampling is going to be a significant burden on Vermont's water systems, and especially on the small systems. Water systems can avoid sampling if it can be shown that their source is not vulnerable to contamination from potential contaminants. Systems that are not vulnerable to these chemicals may be issued a "use waiver" or a "susceptibility waiver."

A use waiver can be issued if a determination is made that either a contaminant was not used, or if it was used manufactured, or stored in the area of review, is not likely to adversely impact a water system.

A susceptibility waiver is applicable if after a thorough review of the water system there is sufficient technical criteria (e.g., well depth, soil type, pesticide leachability, etc.) to determine that the water source is not susceptible to the contaminant. I have enclosed a brief summary of the above compound which endeavors to explain its environmental fate.

We support the issuance of waivers if appropriate. Waivers not only reduce the amount of bureaucratic paperwork but can also save water systems significant money. However, prior

to issuing waivers we must be certain that a threat from a contaminant does not exist. To be certain, I request your input on the above compound.

We need to know whether or not the pesticide was used in Vermont and to what extent. I 'd appreciate information on the total amount of chemical used in the State and when it was used. If used, on what, how is it applied, and does the application require some one who is certified or licensed. Also, is this pesticides found in environment, particularly in water, and finally, does the Department of Agriculture, Food and Markets support the issuance of a statewide waiver for diquat for public community water supply systems.

If you need additional information from me in order to make the requested determinations, I'd be pleased to provide it for you.

Thanks

cc: Jeff Comstock  
John Berino  
David Butterfield  
Jay Rutherford

## ETHYLENE DIBROMIDE

### SYNONYMS

EDB, E-D-Bee, EDB-85, Bromofume, Kopfume, Nephis, Ethylene Dibromide, Celmide, Dowfume, 1,2,-Dibromoethane, Soilbrome, and Glycoldibromide

### PHYSICAL PROPERTIES

EDB is heavy (molecular weight 187.88 and density 2.18 g/ml) and is a colorless liquid. It has a mildly sweet chloroform odor which may not be detected until concentrations are above those recommended. It is water soluble (4310 mg/L) and is stable in water with half life of approximately two years, it is also soluble in alcohol. EDB has a boiling point of 132C and a melting point of 9.5C. Its vapor pressure is 9mm Hg at 20C.

### USE

EDB was used as a pesticide fumigant for soil, grain, and fruit crops. The chemical has been banned for these uses by the Environmental Protection Agency (EPA) in 1983 (EPA, 1987). Currently, EDB is principally used as an additive in gasoline. It is also used for termite and Japanese beetle control, beehive and vault fumigation, and spot fumigation of milling machine (Exttoxnet, 1990). There is no documentation of this chemical being used in Vermont (Vermont Pesticide Summary for 1989).

### ENVIRONMENTAL FATE

EDB is regarded as a highly persistent and mobile pesticide. The major route of removal of EDB from soil is by volatilization (EPA, 1987). However, its presence in the air is due mostly to emissions from automobiles and gasoline centers. In the absence of volatilization, EDB slowly degrades. In 1983, the pesticide was banned and was also found in private and public wells within Connecticut. Two years after the ban on EDB, it was found in Florida's groundwater (Weintrub, 1986). It is thought that EDB becomes trapped in air bubbles in the soil and is buffered from microbial degraders. In this way the pesticide can leach to water systems after long periods (Exttoxnet, 1990). Since EDB is volatile, it is expected to occur more in groundwater than surface water. In the air, high concentrations of EDB are readily absorbed and can damage the lungs (Exttoxnet, 1990).

### Biological Fate

Plants are unable to take EDB up from the soil and it is not likely EDB will accumulate in plants. Its daughter product, inorganic bromide, is taken up by plants in small amounts. An additional by product is ethylene glycol which can further degrade to form the toxic substance formaldehyde. Foods fumigated with EDB may have pesticide residues which persist for 6 to 12 weeks. Cooking can reduce the levels of EDB in food by 78 to 99% (Exttoxnet, 1990). It is also reported (EPA, 1986), that EDB decomposes slowly in the soil by microbial action and has a biodegradation half life of less than 18 weeks. Because EDB volatilizes readily, care should

be taken to prevent inhalation. In studies with rats, inhalation of EDB caused a significant increase in mortality. Tissue analysis determined high concentrations of EDB in the liver, kidney, and stomachs. It was also determined that inhalation can cause damage to human lungs and can reduce sperm counts in men (EPA, 1987)>

#### Soil Fate

Organic matter, clay, and water content are the variables that significantly influence the fate of EDB. In one study core samples were taken between 2.4 and 12.2 meters below ground surface. Lack of organic matter in the lower half of the core along with the absence of EDB, suggest that the pesticide was migrating. This migration was also enhance by leaching which was initiated by irrigation. It was also found that EDB travels almost four times as far in a sandy soil than in a silty clay loam (Duncan, 1986). In general, EDB will leach through a course soil faster than a fine grain soil. The ability of EDB to migrate is facilitated by air bubbles that entrap the pesticide and buffer it from degradation. Any remaining EDB which occurs at the surface is likely to convert to ethylene and bromide ions (Extonet, 1987).

#### Water Fate

EDB is removed from water primarily through evaporation. Otherwise, it will remain stable and persist in water. It can also migrate extensively. Prior to 1983, EDB was used widely on tobacco crops in the Central Valley of Connecticut and has been found in groundwater of the State. It has bee identified in 276 private wells and 54 public wells above the State action level of 0.1 micrograms per liter. Two years after EDB was banned 7,609 wells were tested for the pesticide in Florida and 828 wells showed the presence of EDB. Of these well, 36 were municipal water supplies (Holden, 1986). Most of the contamination remained in the top two hundred feet of the aquifer, although, in one instance a 700 foot deep well was found contaminated. Concentration of EDB ranged between 0.02 to about 600 ppb (Weintraub, 1986), usual levels of EDB found in ground water are between 1.0 to 20.0 ppb (Extonet, 1990). In 1984, the estimated clean up cost in Florida was about 5 million dollars (Holden, 1986). The concentration of EDB appears to affect its chemical half life which is about two years (Weintraub, 1986). Hydrolysis is also a mode of degradation (Extonet, 1990). EDB has been found in the groundwaters of California, South Carolina, Georgia, and Florida (EPA, 1987). In surface water, EDB has a half life of one to five days (Extonet, 1990). It has not been found in surface water supplies (EPA, 1987).

#### Air Fate

EDB is very volatile, it is present in outside air mostly from the emissions from automobiles and fumigation centers. It has a half life of 45 days in the air and is degraded in sunlight. In

one study, workers exposed to low EDB levels in air showed no adverse effect to the chemical. In another study, men exposed to low levels of the chemical for five years experienced low sperm counts (Extonet, 1990). Inhalation is the most hazardous route of exposure to EDB.

#### TOXICITY

EDB is very toxic and is simply describe as dangerous on its label. Inhalation is the most probably route of exposure and lung damage can occur. The inhalation LD50 for rats is 400 ppm for two hours. Four deaths have been attributed to accidental poisoning (Extonet, 1990). The oral LD50 for rats is 108mg/kg. Liver and kidney damage occurs. It is classified by EPA (1987) as both a carcinogen and a mutagen. As mentioned, reduced sperm counts can result in men expose to significant amounts of EDB.

Duncan, D. and Oshima R. 1986. 1,2,-Dibromoethane (EDB) in Two Soil Profiles. California Department of Food and Agriculture, Sacramento, CA

Extonet, 1990. Ethylene Dibromide, Extension Toxicology Network, Extension Offices of Cornell University, The University of California, Michigan University, and Oregon state University.

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United States Environmental Protection Agency, 1987. Ethylene Dibromide, Health Advisory Office of Drinking Water

United States Environmental Protection Agency, 1987. Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy. Office of Pesticide and Toxic Substances, Washington, DC 20460

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STATEWIDE WAIVER REQUEST FOR ENDOTBALL FROM PHASE II MONITORING  
REQUIREMENTS OF PUBLIC SUPPLY WELLS

Submitted to EPA Region I  
Groundwater and Water Supply Unit

by

The Vermont Department of Environmental Conservation

The Phase II Rule is a federal regulation under the Safe Drinking Water Act which became effective January 1, 1993. The Rule established a waiver process based upon contaminant vulnerability. Vermont has reviewed the herbicide endothall to determine source vulnerability regarding this potential contaminant. This review concluded that minimal use of endothall in Vermont should provide the basis to waive statewide monitoring requirements. A statewide waiver means that no sampling need to occur. The resulting reduction in monitoring requirements will provide significant sampling cost savings.

Submission of this Vermont statewide use waiver for endothall per the Phase II Rule is accompanied by supporting documentation. The documentation includes a profile of the herbicide. This profile along use data regarding endothall as kept by the Vermont Department of Agriculture, Food, and Markets, (VDAFM) was evaluated. The attached evaluation was performed by the Plant Industry Division (PID) of VDAFM.

The Vermont Department of Environmental Conservation request a statewide waiver for endothall from EPA. That EPA respond within 30 days to this request because of Vermont's need to prepare public water systems in regard to the Phase II Rule.



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Jay L. Rutherford, P.E. Director  
VT DEC Water Supply Division



## ENDOTHALL

### VERMONT USE

The herbicide endothall is legal for use in Vermont. Pesticide use records dating back to 1985 indicate no use of endothall by commercial applicators. Pesticide sales records indicate no use of endothall by private applicators since 1988.

### USE PATTERNS AND CERTIFICATION REQUIREMENTS

An examination of pesticide use and sales reporting data indicate no use of endothall for at least the past eight (8) years.

Endothall is a "Restricted Use" pesticide in Vermont. Therefore, endothall may only be sold by Class "A" dealers or purchased by certified applicators. Dealer licensing and applicator certification is an examination and training process regulated by the Department of Agriculture, Food and Markets.

Endothall is also labeled as an aquatic herbicide. Aquatic applications of endothall require a permit from the Water Quality Division at D.E.C. The Water Quality Division has no record of permits issued for the use of endothall.

### ENVIRONMENTAL DETECTIONS

There have been no detections of endothall contaminated soil or groundwater in Vermont.

### RECOMMENDATION

The Vermont Department of Agriculture, Food and Markets supports the issuance of a statewide use waiver for the herbicide endothall. The absence of any use in the last eight years supports the conclusion that endothall does not present a risk to the groundwater resources of Vermont.


April, 1993

Agency of Natural Resources  
Department of Environmental Conservation

Water Supply Division  
The Old Pantry  
802-244-1562

MEMORANDUM

To: Philip Benedict, Director  
Plant and Industry Division

From: Jay L. Rutherford, P.E., Director 

Date: March 17, 1993

Subject: Vulnerability of Water Systems to Endothall

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The U.S. Environmental Protection Agency's National Primary Drinking Water Regulations are requiring water systems to monitor for additional chemicals. These chemicals include endothall.

The cost of sampling is going to be a significant burden on Vermont's water systems, and especially on the small systems. Water systems can avoid sampling if it can be shown that their source is not vulnerable to contamination from potential contaminants. Systems that are not vulnerable to these chemicals may be issued a "use waiver" or a "susceptibility waiver."

A use waiver can be issued if a determination is made that either, a chemical was not used, or if it was used, manufactured, or stored in the area of review, is not likely to adversely impact a water system.

A susceptibility waiver is applicable if after a thorough review of the water system there is sufficient technical criteria (e.g., well depth, soil type, pesticide leachability, etc.) to determine that the water source is not susceptible to the contaminant. I have enclosed a brief summary of the above compound which endeavors to explain its environmental fate.

We support the issuance of waivers if appropriate. Waivers not only reduce the amount of bureaucratic paperwork but can also save water systems significant money. However, prior

to issuing waivers the we must be certain that a threat from a contaminant does not exist. To be certain, I request your input on the above compound.

We need to know whether or not the pesticide was used in Vermont and to what extent. I'd appreciate information on the total amount of chemical used in the State and when it was used. If used, on what, how is it applied, and does the application require some one who is certified or licensed. Also, is this pesticides found in environment, particularly in water, and finally, does the Department of Agriculture, Food and Markets support the issuance of a statewide waiver for diquat for public community water supply systems.

If you need additional information from me in order to make the requested determinations, I'd be pleased to provide Your attention to this request is most appreciated.

cc: Jeff Comstock  
John Berino  
David Butterfield

## ENDOTHALL

### SYNONYMS

Accelerate, Aquathol, Des-i-cate, Hydrothol, Hydout, and Endothall Weed Killer

### PHYSICAL PROPERTIES

Endothall has a water solubility of 100,000 mg/L at 20C and a melting point of 144C. Its vapor pressure is negligible and has a half life of seven days under aerobic conditions.

### USE

Endothall is applied to sugar beets, turf, alfalfa, clover, and potato vines. It has also been used as a cotton harvest aid. It is a post-emergence contact herbicide, it acts as a defoliant-desiccant and is primarily for aquatic weed control (Farm Chemical Handbook, 1989). The herbicide prevents plants from manufacturing certain proteins needed for growth. Factors such as density, size, water movement, and water temperature determine how quickly the plant will die. Under favorable conditions, plants begin to weaken and die within a few days (Wisconsin Department of Natural Resources, 1990). There is no documentation of this chemical being used in Vermont (Vermont Pesticide Summary for 1989).

### ENVIRONMENTAL FATE

Released into the environment, endothall is expected to rapidly biodegrade under aerobic conditions. It has a half life of approximately one week but degrades slightly slower under anaerobic conditions. Endothall rapidly leaches through soil, however, biodegradation is its prime route. It is not expected to oxidize, hydrolyze, photolyze, volatilize, bio-accumulate, or adsorb on suspended solids or sediments in water. If released into the atmosphere, endothall exists predominately on particles which either settle out or wash out during precipitation (Howard, Phillip, 1991). Studies in aquatic environments show that endothall disperses with water movement and is broken down into simple molecules of carbon, hydrogen, and oxygen by microorganisms (Wisconsin Department of Natural Resources, 1990). Exposure to the this herbicide is most apt to be from use on lawns.

### Biological Fate

Studies have shown that endothall does not bio-accumulate in organisms (Howard, Phillip, 1991). It has a very low affinity for organic matter and lipids. There is no tendency for it to accumulate in tissues of aquatic organisms (Corte-Real, Lee, 1992). However, endothall is toxic to fish above 0.3 ppm (Wisconsin Department of Natural Resource, 1990). Biotransformation is the major process for removal of endothall from soil and water. It is primarily transformed to glumatic acid (Howard, Phillip, 1991). As mentioned it also degrades to carbon, hydrogen, and oxygen by microorganisms.

## Soil Fate

The soil adsorption coefficient of endothall in sediment/water has been measured to be less than two. Based on a water solubility of 100,00mg/L and the adsorption coefficient, endothall is not expected to adsorb to sediments or suspended solids in water and is highly mobile in soil. It is expected to biodegrade prior to leaching (Howard, Phillip, 1991).

## Water Fate

Endothall has a relatively short persistence in surface waters. This is supported by the fact that there are no components in surface waters that act as sinks for the chemical (Corte-Real, Lee, 1992). If released to water, endothall should rapidly biodegrade. Endothall applied to a pond at various concentrations ranging from 0.3 to 10 ppm was undetectable after an average of 2.5 days and a maximum of 4 days (Howard, Phillip, 1991). Additional field studies indicate reduced concentrations of endothall persist in water for several days to several weeks with an average half life of 5 days (Wisconsin Department of Natural Resources, 1990). Endothall has not been found in groundwater (National Pesticide User Risk of Ground and Surface Water Contamination, 1990).

## Air Fate

If released to the atmosphere, endothall is expected to exist predominantly on particles and should either settle out or wash out in precipitation. Endothall is not expected to chemically react or photolyze in the atmosphere (Howard, Phillip, 1991).

## TOXICITY

Acute effects of undiluted endothall are due to its corrosive properties rather than poisonous effects. Endothall is poorly absorbed through the skin, lungs, or gastrointestinal tract. At low doses acute effects include eye irritation to skin, lungs, and eyes. High doses can be fatal. A No Observed Effect Level of 15 mg/kg/day has been reported for a number of studies (Martin Strayer, D. 1986).

Corte-Real, Lee, 1992. The Commonwealth of Massachusetts, Department of Food and Agriculture, personal communication to Tara Gallagher, Massachusetts Department of Environmental Protection. Farm Chemical Handbook, 1989.

Howard, Phillip, 1991. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Lewis Publishers.

Martin, Strayer, D. 1986. Evaluation of Potential Human and Aquatic Ecological Health Risks Associated with Use of the Aquatic Herbicides 2,4-D, Endothall, and Fluridone

National Pesticide User Risk of Ground and Surface Water Contamination, 1990. University of Massachusetts, Amherst, Massachusetts.

Vermont Pesticide Summary for 1989. personal communication  
with the Vermont Department of Agriculture, 1992.  
Wisconsin Department of Natural Resources, 1990. Chemical  
Fact Sheet: Endothall.

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STATEWIDE WAIVER REQUEST FOR GLYPHOSATE FROM PHASE II MONITORING  
REQUIREMENTS OF PUBLIC SUPPLY WELLS

Submitted to EPA Region I  
Groundwater and Water Supply Unit

by

The Vermont Department of Environmental Conservation

The Phase II Rule is a federal regulation under the Safe Drinking Water Act which became effective January 1, 1993. The Rule established a waiver process based upon contaminant vulnerability. Vermont has reviewed the herbicide glyphosate to determine source vulnerability regarding this potential contaminant. This review concluded that susceptibility to glyphosate contamination is minimal in Vermont which provides the basis to waive statewide monitoring requirements. A statewide waiver means that no sampling need to occur. The resulting reduction in monitoring requirements will provide significant sampling cost savings.

Submission of this Vermont statewide susceptibility waiver for glyphosate per the Phase II Rule is accompanied by supporting documentation. The documentation includes a profile of the herbicide. This profile along use data regarding glyphosate as kept by the Vermont Department of Agriculture, Food, and Markets, (VDAFM) was evaluated. The attached evaluation was performed by the Plant Industry Division (PID) of VDAFM.

The Vermont Department of Environmental Conservation request a statewide waiver for glyphosate from EPA. That EPA respond within 30 days to this request because of Vermont's need to prepare public water systems in regard to the Phase II Rule.



Jay L. Rutherford, P.E. Director  
VT DEC Water Supply Division

## GLYPHOSATE

### VERMONT USE

The herbicide glyphosate is legal for use in Vermont. Pesticide use records dating back to 1985 indicate that the use of glyphosate in Vermont is substantial. The following table lists the pounds of active ingredient of glyphosate used by commercial applicators.

<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
5,609	4,771	10,592	6,688	7,350	5,346	5,670

The use figures listed above represent approximately 40% to 60% of the total annual use for glyphosate. This estimate is based upon the proportion of pesticide applications made by private and commercial applicators for particular groups of compounds.

### USE PATTERNS AND CERTIFICATION REQUIREMENTS

Glyphosate is used extensively by both commercial and private applicators. The agricultural uses of glyphosate include corn, field and forage crops, fruits and vegetables, Christmas trees, orchards, nurseries and greenhouses. The industrial uses of glyphosate include right-of-way maintenance for utilities, railroads and highways, forestry, waste water treatment plants, golf courses and landscaping. Glyphosate is also available for use by home owners on lawns and gardens.

Glyphosate is a "General Use" pesticide in Vermont. Therefore, glyphosate may be sold by Class "B" pesticide dealers. Class "B" dealers are hardware stores and lawn and garden centers. Class "B" pesticides are available to the general public and do not require an applicator to be certified. The Department of Agriculture, Food and Markets does not have records on the amount of glyphosate used by private applicators because dealers are required to report only the sales of restricted use pesticides. Certified private applicators are required to keep records of pesticide use but are not required to submit reports. Glyphosate is also labeled as an aquatic herbicide (Rodeo). Aquatic applications of glyphosate require a permit from the Water Quality Division at D.E.C. Aquatic applications of glyphosate must be made by a certified applicator. The Water Quality Division has a permit on file (issued in 1990) for the use of glyphosate by the U.S. Fish and Wildlife Service within the Missisquoi National Wildlife Refuge in Swanton. The only other permits issued in the past were for private ponds. One each in 1988 and 1990.

April, 1993



#### ENVIRONMENTAL DETECTIONS

There have been no detections of glyphosate contamination of soil, groundwater or surface water in Vermont. The Vermont Department of Agriculture, Food and Markets laboratory has done extensive analytical methodology development for testing glyphosate residues. As cooperative project with the EPA Environmental Testing and Investigation Laboratory, the Vermont Agricultural Laboratory conducted a training workshop and seminar for other state environmental laboratories. As part of this methods development work, Vermont has conducted sampling at sites of glyphosate known use.

Glyphosate is considered to be very immobile in the environment. Residues of glyphosate in soil and water bind very tightly to organic matter and are degraded very rapidly by soil microorganisms. Based on these characteristics, the EPA did not consider it necessary to include glyphosate in the list of analytes for the National Pesticides in Groundwater Survey conducted in 1989 and 1990.

#### RECOMMENDATION

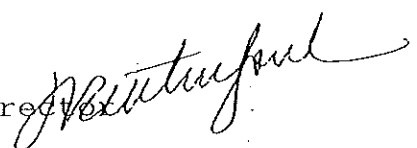
The Vermont Department of Agriculture, Food and Markets supports the issuance of susceptibility waivers for the herbicide glyphosate. Although the use of glyphosate in Vermont is widespread, the available environmental fate data and the lack of detections in groundwater or surface water on a state and national scale support the conclusion that glyphosate does not present a risk to the groundwater resources of Vermont.

Agency of Natural Resources  
Department of Environmental Conservation

Water Supply Division  
The Old Pantry  
802-244-1562

MEMORANDUM

To: Philip Benedict, Director  
Plant and Industry Division

From: Jay L. Rutherford, P.E., Director 

Date: March 17, 1993

Subject: Vulnerability of Water Systems to Glyphosate

---

The U.S. Environmental Protection Agency's National Primary Drinking Water Regulations are requiring water systems to monitor for additional chemicals. These chemicals include Glyphosate.

The cost of sampling is going to be a significant burden on Vermont's water systems, and especially on the small systems. Water systems can avoid sampling if it can be shown that their source is not vulnerable to contamination from potential contaminants. Systems that are not vulnerable to these chemicals may be issued a "use waiver" or a "susceptibility waiver."

A use waiver can be issued if a determination is made that either, a chemical was not used, or if it was used, manufactured, or stored in the area of review. A susceptibility waiver is applicable if after a thorough review of the water system there is sufficient technical criteria (e.g., well depth, soil type, pesticide leachability, etc.) to determine that the water source is not susceptible to the contaminant. I have enclosed a brief summary of the above compound which endeavors to explain its the environmental fate.

We support the issuance of waivers if appropriate. Waivers not only reduce the amount of bureaucratic paperwork but can also save water systems significant money. However, prior to issuing waivers we must be certain that a threat from a contaminant does not exist. To be certain, I request your

input on the above compound.

We need to know whether or not the pesticide was used in Vermont and to what extent. The pesticide usage summary for 1990 and 1990 from your office indicates that glyphosate is commonly used in the state. I'd appreciate information on the total amount of chemical used in the State and when it was used. If used, on what, how is it applied, and does the application require some one who is certified or licensed. Also, is this pesticide found in environment, particularly in water, and finally, does the Department of Agriculture, Food and Markets support the issuance of a statewide waiver for glyphosate for public community water supply systems.

If you need additional information from me in order to make the requested determinations, I'd be pleased to provide it for you.

Thanks

cc: Jeff Comstock  
John Berino  
David Butterfield

## GLYPHOSATE

### SYNONYMS

Roundup, Rodeo, Landmaster, Shakle, Roundup L&G, Polado, Accord

### PHYSICAL PROPERTIES

Clear to amber colored in solution, a white solid. practically odorless. Solubility of glyphosate in water is high at 25 C, it is insoluble in common organic solvents. Vapor pressure is negligible indicating it is non-volatile. It has a melting point of 230 C, a pH of 4.4 to 4.9, the specific gravity is 1.17, and a density of 0.5 g/cm<sup>3</sup> (Smith, Eldon, 1992, Pesticide Directorate 1991, and Farm Chemical Handbook, 1989).

### USE

Glyphosate is marketed as a non-residential, broad spectrum, foliar applied herbicide which is trans-located from treated areas to untreated shoot regions. It is effective on deep rooted perennial species, annual and biannual species of grasses. It is applied in the spring, summer, or fall to undesirable species. It is used for general weed control at industrial, recreational, and public areas such as airports, ditch banks, ditches and canals, fence rows, golf courses, highways, right-of-ways, and farmsteads. It is effective against most plants and used in and around aquatic sites (Farm Chemical Handbook 1989, Herbicide Fact Sheet, MA 1989, Smith, Eldon 1992). Glyphosate has been used in Vermont, in 1990, 5,346 pounds were used and in 1991, 5,670 pounds were used.

### ENVIRONMENTAL FATE

Glyphosate is widely used with little to no hazard to man or the environment. There is no residual soil activity, it does not leach into non-target areas, and it is nonvolatile. It is practically nontoxic to mammals, birds and fish, showing no bio-accumulation in the food chain, it is biodegraded into natural substances. When used correctly, glyphosate poses no threat to the environment or its inhabitants (Smith, Eldon 1992). Biodegradation is considered the major fate process affecting glyphosate, it is biodegraded aerobically and anaerobically by microorganisms present in soil, water, hydrosol, and activated sludge (EPA Health Advisory 1988).

#### Biological Fate

The effect of glyphosate may not be visible for 2-4 days in annuals and up to 7 days for perennial. Glyphosate moves from cell to cell through the plant and is rapidly adsorbed. The herbicide prevents protein synthesis, preventing plant growth which result in death of the plant.

The impact of glyphosate on animals appear to be slight. Glyphosate was administered in the diet of dogs and rats at increasing doses for ninety days. The toxicological effects were evaluated with no significant abnormalities observed ( Smith,

Eldon, 1992). In addition, feeding studies with chickens, cows, and swine showed that ingestion of up to 75 ppm glyphosate resulted in non-detectable glyphosate residue levels. Glyphosate residue was non-detectable in milk and eggs from cows and chickens on diets containing this compound (USEPA Health Advisory, 1988).

Glyphosate was evaluated for acute irritation cumulative irritation, photo-irritation, and allergic and photo-allergic contact potential in 346 volunteers. The herbicide was less irritant than a standard liquid dish washing detergent and a general purpose cleaner (USEPA Health Advisory, 1988).

#### Soil Fate

Glyphosate is not taken up by plant roots because it is tightly bound to the soil. Adsorption to soil particles and organic matter begins almost immediately after application (MA Herbicide Fact Sheet). It is inactivated by contact with soil and then is rapidly biodegraded by soil and water microorganisms into natural products (eg. carbon dioxide, water, nitrogen, and phosphate). There is minimum leaching of glyphosate because it binds so tightly with the soil. In a laboratory study, it was determined that no glyphosate was released from soil contained in columns which were leached with water for 45 days (Herbicide Bulletin, 1982). Soil and water microorganism are not harmed because of glyphosate decomposition. Microorganisms in soil exposed to 5 to 25 ppm of glyphosate showed no adverse affects. Glyphosate is biodegraded rapidly (average soil half-life = 60 days) by soil microorganisms under both aerobic and anaerobic conditions. The breakdown of glyphosate is primarily by microbial degradation as opposed to chemical degradation.

#### Water Fate

Glyphosate when used as recommended by the manufacturer, is unlikely to enter watercourses through run-off or leaching following terrestrial application. One study estimate had 1.85% of the applied chemical lost to runoff (Extension Toxicology Network).

Toxic levels are therefore unlikely to occur in water bodies with normal application rates and practices (MA Herbicide Fact Sheet). Glyphosate in water has been studied under both sterile and non-sterile conditions. As expected glyphosate was stable in sterile water since no microorganisms were available to degrade it and chemical degradation doesn't occur. In laboratory experiments, once bound to suspended soil sediment or deposited in bottom soil, glyphosate biodegrades rapidly with a water half-life of about two weeks. Longer half-lives have been reported in stagnant waters, bogs 7 weeks; swamps 9 weeks; and pond water 10 weeks (Herbicide Bulletin, 1982). Groundwater contamination potential has been demonstrated to be low by the fact there have not been any detection of glyphosate in surface or groundwater in any of 103 samples taken nationwide. In Massachusetts, the Department of Food and Agriculture have sampled four shallow (12 to 28 feet) monitoring wells in close proximity to an area which was sprayed with glyphosate. During the three month sampling period

glyphosate was not detected (Lee Corte Real, 1992).

#### Air Fate

Glyphosate does not vaporize. Since glyphosate does not vaporize there is a reduction of risk to animals and man from vapor exposure. In addition, the likelihood of vapor drift from the application at the site to nontarget areas is reduced (Herbicide Bulletin, 1992).

#### TOXICITY

There have been cases of intentional ingestion of glyphosate, however, the presence of medicines and alcohol were also present. For those cases involving death the patient had on average ingested 200 mL or more of the herbicide. Although minimum ingestion of 100 mL have caused death, others, have survived the ingestion of 500 mL (Smith, Eldon, 1992). Glyphosate has a low toxicity, it has a LD50 of 4900 mg/kg and a dermal LD50 of 7950 mg/kg. It has not been found to be mutagenic, genotoxic, or teratogenic. It is a mild eye irritant and skin irritant (Smith, Eldon, 1992).

Corte Real, Lee, 1992. The Commonwealth of Massachusetts, Department of Food and Agriculture. personnel communication.

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Farm Chemical Handbook, 1989.

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Massachusetts Department of Food and Agriculture, "Herbicide Fact Sheet, Glyphosate" 100 Cambridge Str., Boston MA, 02202  
Pesticide Dictionary, 1989.

Dr. Smith, Eldon, and Dr. Oehme, Frederick, (1992). "The Biological Activity of Glyphosate to Plants and Animals: A Literature Review" Comparative Toxicology Laboratories, College of Veterinary Medicine, Kansas State University, Manhattan, KS 66506-5606

U.S. Environmental Protection Agency, Office of Drinking Water, (1988) Glyphosate Health Advisory.